

Claims

1. An ionic liquid of the general formula

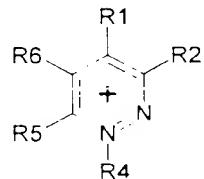
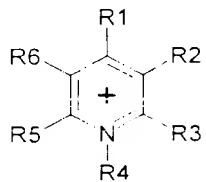


5

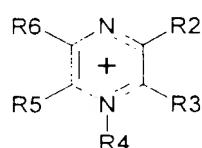
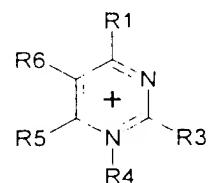
wherein:

K^+ is a cation selected from:

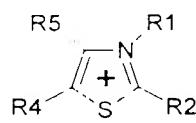
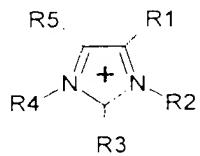
10



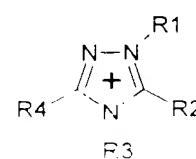
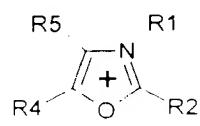
15



20



25



wherein

R¹ to R⁶ are identical or different and are each individually

30

- H,

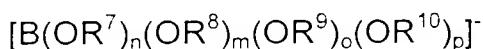
35

partially or fully substituted by F, Cl, N(C_nF_{2n+1}, H_x), O(C_nF_{2n+1}, H_x), SO₂(C_nF_{2n+1}, H_x) or C_nF_{2n+1}, H, wherein 1<n<6 and 0<x<13

- a phenyl radical which is unsubstituted or which is partially or fully substituted by F, Cl, N(C_nF_(2n+1-x)H_x)₂, O(C_nF_(2n+1-x)H_x), SO₂(C_nF_(2n+1-x)H_x) or C_nF_(2n+1-x)H_x wherein 1<n<6 and 0<x≤13

- 5 - one or more pairs of adjacent R¹ to R⁶ can also be an alkylene or alkenylene radical and having up to 8 C atoms, wherein the radical is unsubstituted or partially or fully substituted by halogen, N(C_nF_(2n+1-x)H_x)₂, O(C_nF_(2n+1-x)H_x), SO₂(C_nF_(2n+1-x)H_x) or C_nF_(2n+1-x)H_x wherein 1<n<6 and 0<x≤13

10 wherein A⁻ is an anion selected from



wherein

15 0≤n, m, o, p≤4, and m+n+o+p=4, and

R⁷ to R¹⁰ are different or identical and are each, individually:

20 an aromatic ring selected from a phenyl, naphthyl, anthracenyl and phenanthrenyl ring, which is unsubstituted, or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1<n<6 and 0<x≤13, or halogen,

25 an aromatic heterocyclic ring selected from a pyridyl, pyrazyl and pyrimidyl ring, which is unsubstituted, or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1<n<6 and 0<x≤13, or halogen, or

30 an alkyl radical (C₁ to C₈), which is unsubstituted, or which is partially or fully substituted by F, Cl, N(C_nF_(2n+1-x)H_x)₂, O(C_nF_(2n+1-x)H_x), SO₂(C_nF_(2n+1-x)H_x), or C_nF_(2n+1-x)H_x wherein 1<n<6 and 0<x≤13

and wherein one or more pairs of R⁷ to R¹⁰ can also form

35 an anthracenyliene and phenanthrenyiene ring, which is unsubstituted or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1<n<6 and 0<x≤13, or halogen

an aromatic heterocyclic ring selected from a pyridylene, pyrazylene and pyrimidylene ring, which is unsubstituted, or which is mono-substituted or polysubstituted by $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$, or halogen, or

5 an alkylene or alkenylene radical having up to 8 C atoms and which is unsubstituted or which is partially or fully substituted by halogen, $N(C_nF_{(2n+1-x)}H_x)_2$, $O(C_nF_{(2n+1-x)}H_x)$, $SO_2(C_nF_{(2n+1-x)}H_x)$ or $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$

10 or OR^7 to OR^{10} ,

individually or together, are an aromatic having 6 to 14 C atoms or are aliphatic having 1 to 6 C atoms and which is a carboxyl, dicarboxyl, oxysulfonyl or oxycarbonyl radical, which is unsubstituted, 15 or which is partially or fully substituted by F, Cl, $N(C_nF_{(2n+1-x)}H_x)_2$, $O(C_nF_{(2n+1-x)}H_x)$, $SO_2(C_nF_{(2n+1-x)}H_x)$ or $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$.

20 2. An ionic liquid according to claim 1, wherein at least one of R^1 to R^6 of the cation is an alkyl radical which is unsubstituted or partially or fully substituted by F, Cl, $N(C_nF_{(2n+1-x)}H_x)_2$, $O(C_nF_{(2n+1-x)}H_x)$, $SO_2(C_nF_{(2n+1-x)}H_x)$ or $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$

25 3. An ionic liquid according to claim 1, wherein at least one of R^1 to R^6 of the cation is a phenyl radical which is unsubstituted or partially or fully substituted by F, Cl, $N(C_nF_{(2n+1-x)}H_x)_2$, $O(C_nF_{(2n+1-x)}H_x)$, $SO_2(C_nF_{(2n+1-x)}H_x)$ or $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$.

30 4. An ionic liquid according to claim 1, wherein at least a pair of R^1 to R^6 of the cation is an alkylene or alkenylene radical which is unsubstituted or partially or fully substituted by halogen, $N(C_nF_{(2n+1-x)}H_x)_2$, $O(C_nF_{(2n+1-x)}H_x)$, $SO_2(C_nF_{(2n+1-x)}H_x)$ or $C_nF_{(2n+1-x)}H_x$ wherein $1 < n < 6$ and $0 < x \leq 13$.

5. An ionic liquid according to claim 1, wherein at least one of R^1 to R^6 of the anion is an alkyl radical which is unsubstituted or partially

or fully substituted by F, Cl, N(C_nF_(2n+1-x)H_x)₂, O(C_nF_(2n+1-x)H_x), SO₂(C_nF_(2n+1-x)H_x), or C_nF_(2n+1-x)H_x, wherein 1< n < 6 and 0 < x ≤ 13.

5 6. An ionic liquid according to claim 1, wherein at least one pair of R⁷ to R¹⁰ of the anion is an alkylene or alkenylene radical which is unsubstituted or partially or fully substituted by a halogen, N(C_nF_(2n+1-x)H_x)₂, O(C_nF_(2n+1-x)H_x), SO₂(C_nF_(2n+1-x)H_x) or C_nF_(2n+1-x)H_x wherein 1< n < 6 and 0 < x ≤ 13.

10 7. An ionic liquid according to claim 1, wherein at least one of R⁷ to R¹⁰ of the anion is an aromatic ring selected from a phenyl, naphthyl, anthracenyl and phenanthrenyl ring, which is unsubstituted, or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1< n < 6 and 0 < x ≤ 13, or by a halogen.

15 8. An ionic liquid according to claim 1, wherein at least one of R⁷ to R¹⁰ of the anion is an aromatic heterocyclic ring selected from a pyridyl, pyrazyl and pyrimidyl ring, which is unsubstituted, or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1< n < 6 and 0 < x ≤ 13, or by a halogen (F, Cl or Br).

20 9. An ionic liquid according to claim 1, wherein at least one pair of R⁷ to R¹⁰ of the anion is an aromatic ring selected from a phenylene, naphthylene, anthracenylene and phenanthrenylene ring, which is unsubstituted or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x, wherein 1< n < 6 and 0 < x ≤ 13, or halogen.

25 10. An ionic liquid according to claim 1, wherein at least one pair of R⁷ to R¹⁰ of the anion is an aromatic heterocyclic ring selected from a pyridylene, pyrazylene and pyrimidylene ring, which is unsubstituted, or which is monosubstituted or polysubstituted by C_nF_(2n+1-x)H_x wherein 1< n < 6 and 0 < x ≤ 13, or by halogen.

30 11. An electrochemical cell comprising:

12. A supercapacitor comprised of at least a pair of electrodes, a separator, and the ionic liquid of claim 1.

13. An electrolyte composition comprising an ionic liquid of claim 1 and an aprotic solvent.

14. An electrolyte composition comprising an ionic liquid of claim 1 and a conductive salt.
5

15. A method for making an ionic liquid according to claim 1, comprising reacting a chloride salt of the formula K^+Cl^- with a lithium salt of the formula Li^+A^- within an aprotic solvent.

10

15

20

25

30